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our side the Atlantic, since the passing of the fathers of the last generation, have quite recklessly transgressed, and I, as one of the chief among the transgressors, acknowledge the justice of the reprimand.

It will be questioned that the Vienna congress was truly and fairly international. Many will deny that its regulations are of binding force; and let all that even be denied. Yet the laws that are unwritten are sometimes, it may be, the most binding of all; and I can but regard this expression of the congress as its most important pronouncement; and viewed—if one so view it—as a mere recommendation, it is a most wholesome one.

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FLEAS AND DISEASE.

A NEW and very striking interest now attaches to investigations relative to the connection of fleas with the transmission of disease, in view of the recent specific statements that have been made in connection with the transmission of leprosy by these insects. It is perfectly true that we have very little definite knowledge of the whole matter and that opinions so far expressed are almost purely theoretical. An excellent historical résumé of the subject is given by Dr. Herzog in Bulletin No. 23 of the Bureau of Government Laboratories at Manila. He tells of various efforts to find plague bacilli in fleas or to produce the disease by allowing fleas from diseased rats to bite healthy individuals. Here he might have referred back to Yersin's experience in failing to find the bacilli in the blood from other parts of the body when they were multitudinous in the buboes, and he should have suggested that a flea might have a similar experience. Such a view-point might invalidate much if not most of the experimental work so far accomplished. The 'severe and just' criticisms of Galli-Valerio, made at a time when he was not even acquainted with the species of fleas infesting rats in regions ravaged by the plague, are scarcely worthy of consideration one way or the other. The only serious work on the subject was begun at Syd-

ney, where there was a proper effort to first know the fleas and then to determine if any of the species infesting rats would also bite human beings. Investigators there found *Pulex pallidus* common on rats. This is a very near relative of *P. irritans* and was experimentally determined as able and willing to bite human beings, as might have been expected theoretically. The singling out of this species from all the others found there on rats was a distinct step in advance.

The verdict of the Indian Plague Commission was: No evidence, one way or the other. Indeed, all the way through this discussion, a point that strikes the unprejudiced reader more strongly than any other is the startling paucity of facts—actual observations and experiments—on which all the theories, for and against, have been built. Apparently the most categorical statements are coming from men who do not know the rat fleas of the tropics and subtropics at all. Dr. Herzog adds nothing in the way of adequate experiment, but submits the description of a 'new rat flea'—*Pulex philippinensis*—which may or may not be new, since the description does not include a single diagnostic character to make possible comparisons with any other species. The photographs presented, which are exceedingly poor in detail, indicate a form extremely close to *Pulex irritans*, the flea specific to human beings, which species has, by the way, been taken from rats, cats, dogs, foxes and other animals in regions where it is abundant, a fact of striking importance in this investigation.

There are some most important aspects of the case which have as yet not been considered at all. Most fleas are epicures in their blood-sucking habits where mosquitoes are gluttons. They do not settle and gorge themselves, as do the mosquitoes, but pass rapidly from place to place and bite often. A single flea has been observed to bite so as to leave a dozen or more inflamed spots in as many minutes and yet its abdomen show no extraordinary dilation. The flea possesses a remarkable puncturing apparatus, portions having the appearance of a double-edged saw, with an intricately developed serration. It seems likely that the

flea would have difficulty in wiping its mouth clean after a meal, and indeed microscopical examination made soon after a flea has bitten will reveal blood upon its external mouth parts. If these are snipped off and teased out in a drop of water many blood corpuscles may be found, and if these occur then surely it would be possible for numberless bacilli to lodge there also. This is merely a suggestion—no one known to me has examined the matter properly. Theoretically, a flea drinking blood from a malignant buboe would be pretty likely to have a stomach well filled with the bacilli, and this is said to be the case with the plague as well as with leprosy, though what future relation material that has once passed the flea's throat may have to human beings it is for the bacteriologist to discover, if, indeed, this fact has any bearing of importance whatever. According to Dr. Herzog, Zirolia says that 'the feces of fleas from plague-infected animals contain virulent bacilli, and that in the bodies of the dead fleas these parasites survive for a long time,' though as usual, one of the most important facts—the name of the flea studied—is not given. If a flea bites a malignant buboe and then passes to a healthy individual and inserts the proboscis above described beneath the skin, the bacteriologist is to say what chance there is for inoculation in the inflamed flea-bite, certainly a better chance than with a thrust made by a needle. Seemingly there is almost a physical impossibility that bacilli should not be transferred. In the case of leprosy, a flea which has inserted the above-described proboscis into a malignant lepra blotch is *persona non grata* so far as I am concerned—I would rather not have him transfer his attention to any part of my body, even though I be in more or less ignorance of the possibilities of the case as related to actual infection, resistance or receptivity of different tissues inoculated, etc. Such a statement as Dr. Herzog makes concerning the work of Thompson at Sydney must, it seems to me, serve as a striking call for further investigation. He says, 'Thompson observed blebs which he considered to be produced by fleas and to be the place of entrance of the plague virus, concluding that the transmission of

plague from rats and mice through the intermediation of fleas must be frequent.'

The conflict of opinion all along the line has been amusing when the almost utter lack of definite knowledge on the subject is considered. For instance, in all the talk of rat fleas biting human beings, scarcely a mention has been made of *Pulex irritans* biting rats, though where this species is abundant this is a common occurrence. All theories must be examined, however improbable, from every point of view, and thoroughly sifted, and then the workable residue may form a useful guide for the broadly planned and properly executed experimentation of the future—the only kind of work that will really count.

Surely here is a subject of prime importance calling loudly for systematic and thorough investigation. For after the years of work of specialists and commissions, the plague is still claiming its thousands, and is now on our own shores, and we have to make the fearful admission that the dread blight of leprosy has not only a firm foothold within the United States, but is rapidly spreading, as new localities become infected. It seems as if even the few considerations mentioned above indicated clearly and definitely abundant need for the following initiative lines of work:

I. *Extensive collecting of the fleas infesting rats, cats, dogs and especially human beings, in all parts of the world, but more particularly and thoroughly in all plague- and leprosy-infested regions.* Of such prime importance does the writer consider this preliminary investigation that he recently offered to take all the risks incident to such work and prosecute it vigorously and thoroughly in all the worst plague- and leprosy-infested regions. His somewhat extended experience in tropical field work and special knowledge of the subject seemed to justify and call for such an offer. Whether it will elicit any response remains to be seen. The striking need of the investigation can not be doubted.

II. *An extended and thorough systematic and anatomic study of the species as is now being carried on by the United States government in the case of mosquitoes.* The writer has had such work in progress at his personal

expense for many years and has published a number of papers relating to it.

An invitation has been extended to medical men and others the world over to cooperate. This cooperation, while of the greatest importance, and indeed in default of any of the other support so much needed—of prime importance—can only be disconnected and very incomplete.

Residence in the tropics and in a leprosy center, together with the hearty cooperation of Dr. Howard, of Washington, Dr. Carter, of the University of Texas at Galveston, and others has made possible a good beginning by the writer. Indeed, an interesting result already to be noted is that one of the common rat fleas of the southern gulf ports is the same as the common species in Havana, and of the group of tropical rat fleas closely related to *Pulex irritans*, and thus very likely to bite human beings when opportunity offers. An utter lack of extensive collections from human beings at any of these places makes useful, well-founded deductions on this point impossible. We hope to get these collections in some way. The simplicity of the apparatus needed (tweezers, small homœopathic vials of alcohol and several rat traps) should make extensive collections possible to all who are interested in the subject. Some have complained of the quick movements of the living insects, and the rapidity with which they desert dead animals, as a serious hindrance to the collecting. A little strong pyrethrum powder will remedy these difficulties. Scattered through the fur of an animal, it immediately disables the fleas, and their expiring efforts serve to carry them out, to fall on white paper, where they may be readily and rapidly gathered. As large series as possible should be taken and full data as to locality, host, etc., should be inserted in every vial. A report will be returned for all specimens sent either to the writer or to Dr. Howard, Government Entomologist in Washington, D. C., U. S. A., and full published credit will later be given for every sending.

C. F. BAKER.

ESTACION AGRONOMICA,
SANTIAGO DE LAS VEGAS, CUBA.

SPECIAL ARTICLES.

NOTE ON THE HABITS OF AN OPHIDIID (CUSKEEL).

IN 1871 Professor A. E. Verrill (*Am. Nat.*, 5, p. 399) published a note of half a dozen lines on the *Ophidium marginatum*, remarking that 'this species appears to be very rare and its habits little known.' He "dug two specimens out of the sand near low-water mark, where they burrowed to the depth of a foot or more. When placed upon moist sand, they burrowed into it *tail foremost* with surprising rapidity, disappearing in an instant." These are the only data known to me respecting the habits of any member of the ophidioid family. I was, therefore, much interested to receive confirmatory and additional information about the same species from Dr. E. W. Gudger, of Waynesville, N. C.

It is quite possible, if not probable, that the apparent rarity of the species results from the uncommon manner of life rather than from actual paucity in numbers. Persons generally do not look for fishes in the bare sand.

It is to be hoped that one of the investigators at the Beaufort Laboratory will obtain other specimens and study the habits and food of the species. It is probable that the period of activity is night. It would, therefore, be desirable to examine the stomach-contents as early in the morning as possible.

THEO. GILL.

A NOTE ON THE HABITS OF *RISSOLA MARGINATA*.

ON July 13, 1904, while walking on a sand spit, exposed at low water and lying northwest of the island on which is situated the laboratory of the United States Bureau of Fisheries at Beaufort, N. C., I noticed, thrust out of the wet sand, a conically pointed head which instantly disappeared. Throwing myself down, I immediately began with my bare hands to dig the wet sand where I had seen the head. The animal went down tail first, and so rapidly that I began to despair of capturing it. Presently, however, when I had dug below water level, this little fish was brought out in a great double handful of sand. When taken into the laboratory and put into an aquarium of run-